View metadata, citation and similar papers at core.ac.uk
brought to you by CORE

THE EFFECT OF FERTILISERS ON THE QUALITY OF *PETUNIA X HYBRIDA* „DUVET PINK“

Margarita Davitkovska[1], Vjekoslav Tanaskovic[1], Zvezda Bogevska[1], Gordana Popsimonova[1], Rukie Agic[1], Boris Dorbic[2]

[1]Faculty of Agricultural Sciences and Food-Skopje, Ss. Cyril and Methodius University in Skopje, Republic of Macedonia
[2] University of Applied Sciences „Marko Marulić“ in Knin, Department of agriculture karst, Knin, Republic of Croatia

Corresponding author: dmarge77@yahoo.com

Abstract
The research was conducted in order to analyse the effect of different types of fertilizers on morphological parameters of *Petunia x hybrida* „Duvet pink“. Three different types of liquid fertilisers – Magnicvet with NPK 7-1-5 + ME, Magnihortal with NPK 10-5-5 + ME and Humifulvil, with three different concentrations were used in the experiment. According to the methodology of work and the objective of the examination, following biometric parameters were analysed: plant height (cm), stem thickness (mm), number of branches, number of flower buds and number of flowers. These biometric parameters were measured 40 days after planting into pots. The highest stem thickness and number of branches has the plants fertilized with Magnicvet with concentration of 0,4 %. The highest number of inflorescences has the plants fertilized with Magnicvet with concentration of 0,3 %. The highest plant height has plants fertilized with Magnihortal with concentration of 0,4 %. The highest number of flowers has plants fertilized with Humifulvil with concentration of 0,5 %. The analysed biometric parameters have shown that the liquid mineral fertiliser Magnicvet is more appropriate compared with the liquid mineral fertilizers Magnihortal and Humifulvil.

Keywords: biometric parameters, concentration, measurements.

Introduction

Petunia hybrida hort. was created by cross breeding of *Petunia axillaris* Lam. and *Petunia integrifolia* Hook (Dole and Wilkins, 1999). *Petunia hybrida* is an annual flower. Its period of blooming lasts from May to September. In open field it is planted from mid-May whereas the distance between the plants should be 20-30 cm (Mayer, 2006). *Petunia hybrida* L. is used for flower-beds, and it is also very suitable for containers, pots and hanging flower baskets (Hessayon, 2004, Karlović et al., 2005, Paradžiković, 2012). *Petunia hybrida* belongs to semi resistant annual flowers which are being sown in greenhouses and they are replanted in the open field when there is no danger of frost (Hessayon, 1997). Optimal pH is 6,0 and EC 0,5 – 1,0 mS/cm (Hamrick, 2003). The success of the production of seasonal flowers is in direct dependence of the types of fertilizers. It is known that the quality of seedling depends on several factors such as: the quality of seed, type of substrate, climatic conditions in the region, equipment (technical equipment) and the type of the greenhouse. Besides the above mentioned factors, equally important is the type and concentration of fertilizer which is used in the production. The use of the most appropriate fertilizer has high significance for the obtaining of quality seedlings, which further reflects on growth and development of flower culture. Hence, it is estimated that although it is one of the segments in the production of seedlings, the impact of certain types of fertilizers on the quality of the seedlings of flowers is of great importance. Therefore this research demonstrates that the application of certain fertilizer with certain concentration has a significant role in the production of seedlings.

Material and methods

The examination was made in the farm "Flower-Garden" in the village Vladevci, Strumica, Republic of Macedonia. The experiment was conducted on *Petunia x hybrida* „Duvet pink". The seed was from a Dutch factory Syngenta. The process of seedlings production from seed was carried out at a private farm "Flower-Garden". Substrate used for seedlings production of Petunia x hybrid „Duvet pink". is known as "Profimix 2 Surfinia" and the manufacturer is JSC "DURPETA" from Lithuania. This substrate is universal for production of flower seedlings. Three different types of liquid fertilizers – Magnicvet with NPK 7-1-5 + ME, Magnihortal with NPK 10-5-5 + ME and Humifulvil, with three different concentrations were used in the experiment. Seedlings of *Petunia hybrida* were grown from seeds which were delivered from Netherlands, factory Syngenta. The seeds were planted in containers and grown in containers up to germination and formation of the first two to three leaves. The seedlings were manually taken out of the container and replanted in plastic pots with 9,5 cm diameter. The experiment contained nine variants. Every variant was consisted of 15 plants or a total of 135 plants in experiment. Fertilization was started when the seedlings had 3 to 4 leaves. 100 ml of solution was applied manually on one plant, i.e. one seedling. They were fertilized once a week. During the experiment 5 fertilizations were conducted. Types of fertilizers, their concentrations and solution are displayed in the following table.

Table 1. Fertilization regime in the experiment

Variant	Type of fertilizer	Concentration	Solution	Number of plants
Variant I	Magnicvet	0,2%	3 ml / 1,5 l	15
Variant II	Magnicvet	0,3 %	4,5 ml / 1,5 l	15
Variant III	Magnicvet	0,4 %	6 ml / 1,5 l	15
Variant IV	Magnihortal	0,2 %	3 ml / 1,5 l	15
Variant V	Magnihortal	0,3 %	4,5 ml / 1,5 l	15
Variant VI	Magnihortal	0,4 %	6 ml / 1,5 l	15
Variant VII	Humifulvil	0,5 %	7,5 ml / 1,5 l	15
Variant VIII	Humifulvil	0,7 %	10,5 ml / 1,5 l	15
Variant IX	Humifulvil	1,0 %	15 ml / 1,5 l	15

When the plants have been replanted from the containers to plastic pots irrigation was immediately carried out. After that irrigation was conducted twice a week. Every plant was irrigated manually with 100 ml of clean water. Measurements of biometric parameters were conducted in the laboratory of Department of vegetable and flower crop production, at the Faculty of Agricultural Sciences and Food in Skopje, University „Sv. Cyril and Methodius"in Skopje. 15 plants of every variant were measured, after 40 days of transplanting in the plastic pots. Following biometric parameters were analysed: plant height (cm), stem thickness (mm), number of branches, number of flower buds and number of flowers. The received results were statistically processed according to the method of analysis of variance and test with LSD (Least Significant Difference) test.

Results and discussion

The highest average value for the height of plants (9,30 cm) was obtained in the plants from variant VI. The plants from variant V showed similar results as variant VI with an average value of 9,16 cm. Lowest average value for the height of plants (6,49 cm) was obtained in the variant VIII. Plants from variant IX had the most heterogeneous height (CV 25,91%). The height of plants from variant III showed significant statistical difference at a level of 0.05 compared with the height of plants from the variant I. The height of plants from variants VIII and IX showed significant statistical difference at a level of 0.01 compared with the height of plants from the variant I. The height of plants from variants V, VI and VIII showed significant statistical difference at a level of 0.05 compared with the height of plants from the variant II. Variants V and VI showed significant statistical difference at a level of 0.01 compared with variant III. Variant IX showed significant statistical difference at a level of

0.05 compared with variant IV. Variant VIII showed significant statistical difference at a level of 0.01 compared with variant IV. Also, variant VII showed significant statistical difference at a level of 0.05 compared with variant V. Variants VIII and IX showed significant statistical difference at a level of 0.01 compared with variant V. Variant VII showed significant statistical difference at a level of 0.05 compared with variant VI. Variants VIII and IX showed significant statistical difference at a level of 0.01 compared with variant VI. Variant VIII showed significant statistical difference at a level of 0.05 compared with variant VII. The stem thickness was largest in variant III (4,29 mm). The lowest stem thickness had plants of variant VIII, with the average value of 3,63 mm. The most heterogeneous coefficient of variation had plants from variant VIII with CV 27,66%.

Table 2. Height of plants (cm)

Variant	Arithmetic Mean	Standard Deviation	Coefficient of Variation	Interval of Variation
I	8.56	1.09	12.74	7.0-11.0
II	7.88	1.20	15.18	5.8-9.8
III	7.41	0.99	13.31	5.0-9.3
IV	8.19	1.30	15.90	6.0-10.7
V	9.16	1.73	18.85	7.0-12.0
VI	9.30	1.33	14.35	7.1-12.0
VII	7.96	1.23	15.39	6.0-9.5
VIII	6.49	1.33	20.43	4.0-9.7
IX	6.87	1.78	25.91	5.0-12.0

Table 3. Height of plants (cm) – Comparison between variants

Variant	Comparison with Var. I	Comparison with Var. II	Comparison with Var. III	Comparison with Var. IV	Comparison with Var. V	Comparison with Var. VI	Comparison with Var. VII	Comparison with Var.VIII	Comparison with Var. IX
I	Var. I	0.68	1.15	0.37	-0.6	-0.74	0.6	2.07	1.69
II	-0.68	Var. II	0.47	-0.31	-1.28	-1.42	-0.08	1.39	1.01
III	-1.15	-0.47	Var.III	-0.78	-1.75	-1.89	-0.55	0.92	0.54
IV	-0.37	0.31	0.78	Var. IV	-0.97	-1.11	0.23	1.7	1.32
V	0.6	1.28	1.75	0.97	Var. V	-0.14	1.2	2.67	2.29
VI	0.74	1.42	1.89	1.11	0.14	Var.VI	1.34	2.81	2.43
VII	-0.6	0.08	0.55	-0.23	-1.2	-1.34	Var.VII	1.47	1.09
VIII	-2.07	-1.39	-0.92	-1.7	-2.67	-2.81	-1.47	Var.VIII	-0.38
IX	-1.69	-1.01	-0.54	-1.32	-2.29	-2.43	-1.09	0.38	Var. IX

LSD 0.05 =1,13
LSD 0.01 =1,56

Table 4. Stem thickness (mm)

Variant	Arithmetic Mean	Standard Deviation	Coefficient of Variation	Interval of Variation
I	4.16	0.70	16.94	3.0-5.3
II	4.17	1.12	26.80	2.3-6.0
III	4.29	0.82	19.05	3.0-5.4
IV	4.28	0.67	15.67	3.0-5.7
V	3.96	0.75	19.01	2.6-5.3
VI	4.18	0.74	17.68	3.0-5.2
VII	4.01	0.81	20.18	2.0-5.2
VIII	3.63	1.00	27.66	2.0-6.0
IX	3.70	0.62	16.79	3.0-5.0

The stem thickness from variants VIII and IX showed significant statistical difference at a level of 0.05 compared with the stem thickness from the variant III. The stem thickness from variants VIII and IX showed significant statistical difference at a level of 0.05 compared with the stem thickness from the variant IV. Between the remaining variants there was no statistically significant difference (Table 5).

Table 5. Stem thickness (mm) – Comparison between variants

Variant	Comparison with Var. I	Comparison with Var. II	Comparison with Var. III	Comparison with Var. IV	Comparison with Var. V	Comparison with Var. VI	Comparison with Var. VII	Comparison with Var.VIII	Comparison with Var. IX
I	Var. I	-0.01	-0.13	-0.12	0.2	-0.02	0.15	0.53	0.46
II	0.01	Var. II	-0.12	-0.11	0.21	-0.01	0.16	0.54	0.47
III	0.13	0.12	Var.III	0.01	0.33	0.11	0.28	0.66	0.59
IV	0.12	0.11	-0.01	Var. IV	0.32	0.1	0.27	0.65	0.58
V	-0.2	-0.21	-0.33	-0.32	Var. V	-0.22	-0.05	0.33	0.26
VI	0.02	0.01	-0.11	-0.1	0.22	Var.VI	0.17	0.55	0.48
VII	-0.15	-0.16	-0.28	-0.27	0.05	-0.17	Var.VII	0.38	0.31
VIII	-0.53	-0.54	-0.66	-0.65	-0.33	-0.55	-0.38	Var.VIII	-0.07
IX	-0.46	-0.47	-0.59	-0.58	-0.26	-0.48	-0.31	0.07	Var. IX

LSD 0.05 =0,57

LSD 0.01 =0,79

The number of branches was largest in variant III, with 10,60 branches. The lowest number of branches had plants of variant I, with the average value of 9,33 branches. The most heterogeneous coefficient of variation had plants from variant IV with CV 20,32%.

Table 6. Number of branches

Variant	Arithmetic Mean	Standard Deviation	Coefficient of Variation	Interval of Variation
I	9.33	1.59	17.02	6-12
II	10.27	1.58	15.39	8-13
III	10.60	1.30	12.25	9-12
IV	9.93	2.02	20.32	5-12
V	9.73	1.62	16.69	6-12
VI	9.67	1.29	13.36	8-12
VII	9.47	1.55	16.40	7-12
VIII	9.80	1.32	13.47	8-12
IX	9.40	1.88	20.02	7-13

The number of branches from variant III showed significant statistical difference at a level of 0.05 compared with the number of branches from the variant I. Between the remaining variants there was no statistically significant difference (Table 7). The highest average number of inflorescences (13,07 inflorescences) was obtained in plants from variant II. Plants from the variant VII had the lowest values, with an average value of 8,00 inflorescences. Plants from variant V had the most heterogeneous number of inflorescences (CV 31,19%).

Table 7. Number of branches – Comparison between variants

Variant	Comparison with Var. I	Comparison with Var. II	Comparison with Var. III	Comparison with Var. IV	Comparison with Var. V	Comparison with Var. VI	Comparison with Var. VII	Comparison with Var.VIII	Comparison with Var. IX
I	Var. I	-0.94	-1.27	-0.6	-0.4	-0.34	-0.14	-0.47	-0.07
II	0.94	Var. II	-0.33	0.34	0.54	0.6	0.8	0.47	0.87
III	1.27	0.33	Var.III	0.67	0.87	0.93	1.13	0.8	1.2
IV	0.6	-0.34	-0.67	Var. IV	0.2	0.26	0.46	0.13	0.53
V	0.4	-0.54	-0.87	-0.2	Var. V	0.06	0.26	-0.07	0.33
VI	0.34	-0.6	-0.93	-0.26	-0.06	Var.VI	0.2	-0.13	0.27
VII	0.14	-0.8	-1.13	-0.46	-0.26	-0.2	Var.VII	-0.33	0.07
VIII	0.47	-0.47	-0.8	-0.13	0.07	0.13	0.33	Var.VIII	0.4
IX	0.07	-0.87	-1.2	-0.53	-0.33	-0.27	-0.07	-0.4	Var. IX

LSD 0.05 =1,23, LSD 0.01 =1,70

Table 8. Number of inflorescences

Variant	Arithmetic Mean	Standard Deviation	Coefficient of Variation	Interval of Variation
I	11.87	2.20	18.54	8-18
II	13.07	2.40	18.40	10-18
III	12.93	2.37	18.36	7-16
IV	11.57	3.37	29.10	4-17
V	10.73	3.35	31.19	6-15
VI	10.87	3.14	28.86	5-18
VII	8.00	2.20	27.55	5-12
VIII	8.27	2.22	26.84	6-13
IX	9.13	2.00	21.85	5-12

The number of inflorescences in plants from variants VII and VIII showed significant statistical difference at a level of 0.05 compared with the number of inflorescences from plants of the variant I. Variant IX showed significant statistical difference at a level of 0.05 compared with variant II. Variants VII and VIII showed significant statistical difference at a level of 0.01 compared with variant II. Between the variants IX and III there was statistically significant difference at a level of 0.05. Variants VII and VIII showed significant statistical difference at a level of 0.01 compared with variant III. Variants VII and VIII showed significant statistical difference at a level of 0.05 compared with variant IV. Between the remaining variants there was no statistically significant difference (Table 9).

Table 9. Number of inflorescences – Comparison between variants

Variant	Comparison with Var. I	Comparison with Var. II	Comparison with Var. III	Comparison with Var. IV	Comparison with Var. V	Comparison with Var. VI	Comparison with Var. VII	Comparison with Var.VIII	Comparison with Var. IX
I	Var. I	-1.2	-1.06	0.3	1.14	1.0	3.87	3.6	2.74
II	1.2	Var. II	0.14	1.5	2.34	2.2	5.07	4.8	3.94
III	1.06	-0.14	Var.III	1.36	2.2	2.06	4.93	4.66	3.8
IV	-0.3	-1.5	-1.36	Var. IV	0.84	0.7	3.57	3.3	2.44
V	-1.14	-2.34	-2.2	-0.84	Var. V	-0.14	2.73	2.46	1.6
VI	-1.0	-2.2	-2.06	-0.7	0.14	Var.VI	2.87	2.6	1.74
VII	-3.87	-5.07	-4.93	-3.57	-2.73	-2.87	Var.VII	-0.27	-1.13
VIII	-3.6	-4.8	-4.66	-3.3	-2.46	-2.6	0.27	Var.VIII	-0.86
IX	-2.74	-3.94	-3.8	-2.44	-1.6	-1.74	1.13	0.86	Var. IX

LSD 0.05 =2,99, LSD 0.01 =4,12

The highest average value for the number of flowers was obtained in the plants from the variant VII (9,13 flowers). Lowest average value for the number of flowers (1,27 flowers) was obtained in the variant III. Plants from variant IV had the most heterogeneous height (CV 81,32%).

Table 10. Number of flowers

Variant	Arithmetic Mean	Standard Deviation	Coefficient of Variation	Interval of Variation
I	1.53	0.64	41.74	1-3
II	2.13	1.60	74.89	1-7
III	1.27	0.46	36.14	1-2
IV	4.36	3.54	81.32	1-12
V	7.93	2.94	37.05	3-14
VI	8.27	3.22	38.92	1-13
VII	9.13	2.26	24.78	5-12
VIII	8.53	4.56	53.49	2-15
IX	6.00	3.55	59.09	2-13

The number of flowers from variants IV, V, VI, VII, VIII and IX showed significant statistical difference at a level of 0.01 compared with the number of flowers from the variant I. The number of flowers from variants IV, V, VI, VII, VIII and IX showed significant statistical difference at a level of 0.01 compared with the number of flowers from the variant II. The number of flowers from variants IV, V, VI, VII, VIII and IX showed significant statistical difference at a level of 0.01 compared with the number of flowers from the variant III. The number of flowers from variants V, VI, VII, VIII and IX showed significant statistical difference at a level of 0.01 compared with the number of flowers from the variant IV. The number of flowers from variant VII showed significant statistical difference at a level of 0.05 compared with the the number of flowers from the variant V. The number of flowers from variant IX showed significant statistical difference at a level of 0.01 compared with the number of flowers from the variant V. The number of flowers from variant IX showed significant statistical difference at a level of 0.01 compared with the number of flowers from the variant VI. The number of flowers from variant IX showed significant statistical difference at a level of 0.01 compared with the number of flowers from the variant VII. The number of flowers from variant IX showed significant statistical difference at a level of 0.01 compared with the number of flowers from the variant VIII.

Table 11. Number of flowers – Comparison between variants

Variant	Comparison with Var. I	Comparison with Var. II	Comparison with Var. III	Comparison with Var. IV	Comparison with Var. V	Comparison with Var. VI	Comparison with Var. VII	Comparison with Var.VIII	Comparison with Var. IX
I	Var. I	-0.6	0.26	-2.83	-6.4	-6.74	-7.6	-7.0	-4.47
II	0.6	Var. II	0.86	-2.23	-5.8	-6.14	-7.0	-6.4	-3.87
III	-0.26	-0.86	Var.III	-3.09	-6.66	-7.0	-7.86	-7.26	-4.73
IV	2.83	2.23	3.09	Var. IV	-3.57	-3.91	-4.77	-4.17	-1.64
V	6.4	5.8	6.66	3.57	Var. V	-0.34	-1.2	-0.6	1.93
VI	6.74	6.14	7.0	3.91	0.34	Var.VI	-0.86	-0.26	2.27
VII	7.6	7.0	7.86	4.77	1.2	0.86	Var.VII	0.6	3.13
VIII	7.0	6.4	7.26	4.17	0.6	0.26	-0.6	Var.VIII	2.53
IX	4.47	3.87	4.73	1.64	-1.93	-2.27	-3.13	-2.53	Var. IX

LSD 0.05 =1,06

LSD 0.01 =1,46

Conclusions

The use of the most appropriate fertilizer has high significance for the obtaining of quality seedlings, which further reflects on growth and development of flower culture. Hence, it is estimated that although it is one of the segments in the production of seedlings, the impact of certain types of fertilizers on the quality of the seedlings of flowers is of great importance. Therefore this research demonstrates that the application of certain fertilizer with certain concentration has a significant role in the production of seedlings. Three different types of liquid fertilizers – Magnicvet with NPK 7-1-5 + ME, Magnihortal with NPK 10-5-5 + ME and Humifulvil, with three different concentrations were used in the experiment. The quality of seedlings of *Petunia x hybrida* „Duvet pink" was determined by examination of following biometric parameters: height of plants (cm), stem thickness (mm), number of branches, number of flower buds and number of flowers. The highest average value for the height of plants (9,30 cm) was obtained in the plants fertilized with Magnihortal with concentration of 0,4 %. The highest stem thickness (4,29 mm) and number of branches (10,60 branches) has the plants fertilized with Magnicvet with concentration of 0,4 %. The highest average value for number of inflorescences (13,07 inflorescences) has the plants fertilized with Magnicvet with concentration of 0,3 %. The highest average value for the number of flowers (9,13 flowers) has plants fertilized with Humifulvil with concentration of 0,5 %.

References

1. Dole, M. J., Wilkins, H. F. (1999). Floriculture. Principles and Species, Prentice-Hall, Upper Saddle River, N. J, 464-465.
2. Hamrick, D. (2003). Crop Production Volume 2, Ball Redbook 17th edition. Ball Publishing, 567-574.
3. Hessayon, D. G. (1997). Sve o vrtu. Mozaik knjiga, Zagreb, 28.
4. Hessayon, D. G. (2004). Cvijeće u vrtu. Mozaik knjiga, Zagreb, 33.
5. Karlović, K., Pagliarini, N., Vrdoljak, A., Vršek, I. (2005). Sobno i balkonsko cvijeće. Gospodarski list, 98.
6. Mayer, J. (2006). Cvijeće za balkone i terase. Mozaik knjiga, Grupa mladinska knjiga, 106-107.
7. Paradžiković, N. (2012). Osnove cvjećarstva. Interna skripta, Poljoprivredni fakultet Osijek, 83-86.